# Power Supplies

SPU Series

DC Input

Single Output, General-Purpose

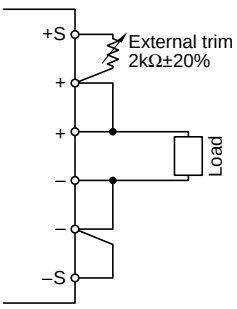
## SPECIFICATIONS

### 50W TYPE

| Part No. | | | SPU05-10R | SPU12-4R2 | SPU15-3R3 | SPU24-2R1 |
|---|---|---|---|---|---|---|
| Output voltage, current | | | 5V • 10A | 12V • 4.2A | 15V • 3.3A | 24V • 2.1A |
| Maximum output power*1 | | W | 50 | 50.4 | 49.5 | 50.4 |
| Input requirements | | | | | | |
| Input voltage Edc | | V | 88 to 185[Rating:110-165] | | | |
| Input current | | A | 0.6typ./0.4typ.[110/165V input, at maximum output power](Without internal fuse) | | | |
| Efficiency | | % | 80typ.[25°C, input and output ratings] | 83typ.[25°C, input and output ratings] | | |
| Output characteristics | | | | | | |
| Output voltage*2 | | V | 5 | 12 | 15 | 24 |
| Voltage variable range*2 | | V | 4.5 to 5.5 | 10.8 to 13.2 | 13.5 to 16.5 | 21.6 to 26.4 |
| Maximum output current | | A | 10 | 4.2 | 3.3 | 2.1 |
| Overvoltage threshold | | V | 5.5 to 6.9 | 13.7 to 15.7 | 17 to 19 | 27 to 30.5 |
| Overcurrent threshold | | A | 10.3 to 13.5 | 4.3 to 5.7 | 3.5 to 4.5 | 2.2 to 2.9 |
| Voltage stability | Input variation | % | 0.5typ.(2max.)[Within the input voltage range] | | Total variation ±1.5typ.(±3max.) | |
| | Load variation | % | 1typ.(2max.)[10 to 100% load] | | | |
| | Temperature variation | % | 0.5typ.(2max.)[Case temperature 0 to +70°C] | | | |
| | Drift | % | 0.1typ.(0.5max.)[25°C, input and output ratings, after input voltage ON for 30min to 8h] | | | |
| | Dynamic load | %/ms | ±4max./1max.[50 to 100% sudden load change] | | | |
| Ripple Ep-p | | mV | 150max. | 200max. | 200max. | 200max. |
| Ripple noise Ep-p | | mV | 250max. | 300max. | 300max. | 400max. |
| Accessory equipment | | | | | | |
| Overvoltage protection | | | Voltage shielding type, recovers upon reset. | | | |
| Overcurrent protection | | | Fixed current threshold type, automatic recovery. | | | |
| Remote ON-OFF | | | Yes | | | |
| Remote sensing | | | Yes | | | |
| Standards | | | | | | |
| Safety standards*3 | | | UL1950D3, CSA ELECTRICAL BULLETIN No.1402C approved. | | | |
| Constructions | | | | | | |
| External dimensions H×W×L | | mm | 12.7×58×115 | | | |
| Weight | | g | 120max. | | | |
| Mounting method | | | Mount via terminal to containing surface (soldering and bolting). | | | |
| Case material | | | Nonflammable resin(UL Grade 94V-0) | | | |
| Heat sink | | | Sold separately(Part No.:3JR0AB179) | | | |

*1 Maximum output power varies depending upon the structure of the heat sink attached to the power supply case and upon the velocity of air blown by a cooling fan against the heat sink. The maximum output power values shown in the table were determined using a 50W standard heat sink(3JR0AB179) and 1.7m/s air velocity.

*2 Determination of output voltage
External trim voltage adjustment must be used to set output voltage.




*3 Conditions
Heat sink size:H12×W56×L115mm min.
Fan air velocity:1.7m/s
Input protection fuse:externally installed 1.5 to 2A rating(normal type).

# Power Supplies

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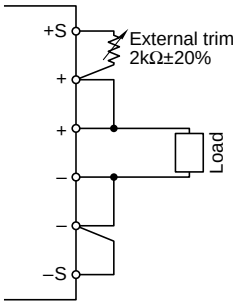
**SPECIFICATIONS**

**100W TYPE**

| Part No. | | | SPU05-20R | SPU12-8R3 | SPU15-6R6 | SPU24-4R2 |
|---|---|---|---|---|---|---|
| Output voltage, current | | | 5V • 20A | 12V • 8.3A | 15V • 6.6A | 24V • 4.2A |
| Maximum output power*1 | | W | 100 | 99.6 | 99 | 100.8 |
| Input requirements | | | | | | |
| Input voltage Edc | | V | 88 to 185[Rating:110-165] | | | |
| Input current | | A | 1.2typ./0.8typ.[110/165V input, at maximum output power](Without internal fuse) | | | |
| Efficiency | | % | 80typ.[25°C, input and output ratings] | 83typ.[25°C, input and output ratings] | | |
| Output characteristics | | | | | | |
| Output voltage*2 | | V | 5 | 12 | 15 | 24 |
| Voltage variable range*2 | | V | 4.5 to 5.5 | 10.8 to 13.2 | 13.5 to 16.5 | 21.6 to 26.4 |
| Maximum output current | | A | 20 | 8.3 | 6.6 | 4.2 |
| Overvoltage threshold | | V | 5.5 to 6.9 | 13.7 to 15.7 | 17 to 19 | 27 to 30.5 |
| Overcurrent threshold | | A | 20.6 to 27 | 8.5 to 11.2 | 6.8 to 8.9 | 4.3 to 5.7 |
| Voltage stability | Input variation | % | 0.5typ.(2max.)[Within the input voltage range] | | Total variation ±1.5typ.(±3max.) | |
| | Load variation | % | 1typ.(2max.)[10 to 100% load] | | | |
| | Temperature variation | % | 0.5typ.(2max.)[Case temperature 0 to +70°C] | | | |
| | Drift | % | 0.1typ.(0.5max.)[25°C, input and output ratings, after input voltage ON for 30min to 8h] | | | |
| | Dynamic load | %/ms | ±4max./1max.[50 to 100% sudden load change] | | | |
| Ripple Ep-p | | mV | 150max. | 200max. | 200max. | 200max. |
| Ripple noise Ep-p | | mV | 250max. | 300max. | 300max. | 400max. |
| Accessory equipment | | | | | | |
| Overvoltage protection | | | Voltage shielding type, recovers upon reset. | | | |
| Overcurrent protection | | | Fixed current threshold type, automatic recovery. | | | |
| Remote ON-OFF | | | Yes | | | |
| Remote sensing | | | Yes | | | |
| Standards | | | | | | |
| Safety standards*3 | | | UL1950D3, CSA ELECTRICAL BULLETIN No.1402C approved. | | | |
| Constructions | | | | | | |
| External dimensions H×W×L | | mm | 12.7×58×130 | | | |
| Weight | | g | 160max. | | | |
| Mounting method | | | Mount via terminal to containing surface (soldering and bolting). | | | |
| Case material | | | Nonflammable resin(UL Grade 94V-0) | | | |
| Heat sink | | | Sold separately(Part No.:3JR0AB163) | | | |

*1 Maximum output power varies depending upon the structure of the heat sink attached to the power supply case and upon the velocity of air blown by a cooling fan against the heat sink. The maximum output power values shown in the table were determined using a 100W standard heat sink(3JR0AB163) and 1.7m/s air velocity.

*2 Determination of output voltage
External trim voltage adjustment must be used to set output voltage.




*3 Conditions
Heat sink size:H20×W57×L128mm min.
Fan air velocity:1.7m/s
Input protection fuse:externally installed 2.5 to 3A rating(normal type).

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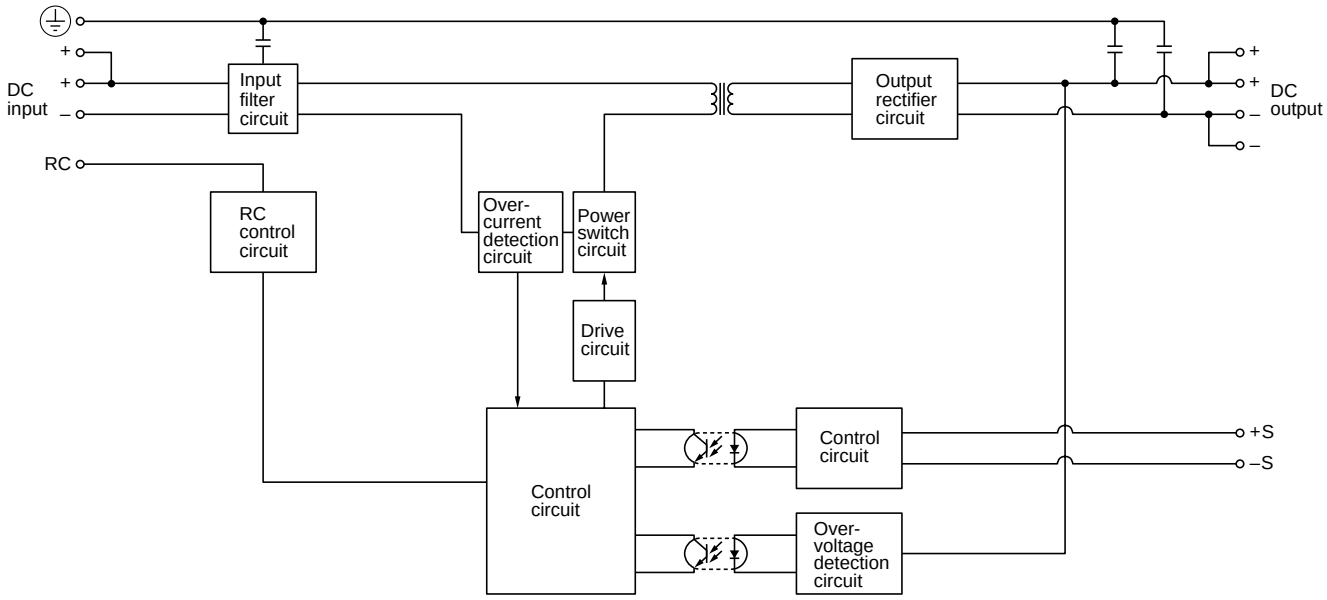
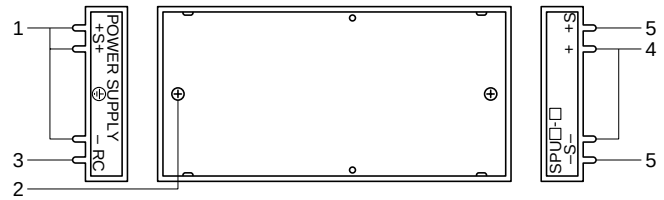
**BLOCK DIAGRAM**

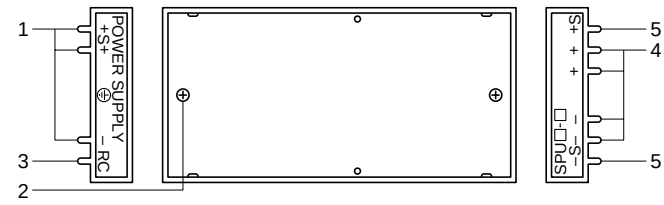



**TERMINAL DESIGNATIONS AND FUNCTIONS**

**50W TYPE**




**100W TYPE**




Terminal No. 1: DC input terminals(DC INPUT)
Connect to DC input lines.

Terminal No. 2: Frame ground hole(G)
Connect the M4-tapped hole(located on frame bottom surface next to terminals) to earth ground.

Terminal No. 3: Remote ON-OFF terminal(RC)
The output voltage is turned ON-OFF by TTL level control voltage applied between the RC terminal and the (–) input terminal.
Output is ON when this control voltage level(H) is within the 2.4 to 5V range, or control is open.
Output is OFF when this control voltage level(L) is within the 0 to 0.4V range, or control is shorted.
Since the RC terminal is internally pulled up, the RC terminal should be left open when not used.

Terminal No. 4: DC output terminals(+, –)
Connect to load.

Terminal No.5: Output voltage adjustment terminals/remote sensing terminals(+S, –S)
These are used when correcting voltage drop to load, or when setting the output voltage.

# Power Supplies

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DC Input

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**COMMON SPECIFICATIONS**

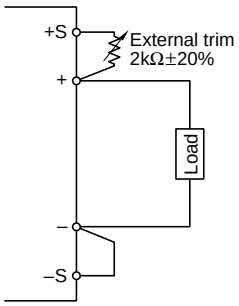
| | | |
|---|---|---|
| Temperature range | Operating | 0 to +50°C |
| | Storage | –25 to +80°C |
| Humidity range | Operating | 20 to 95(%)RH[Maximum wet-bulb temperature:35°C, without dewing] |
| | Storage | |
| Amplitude | 5 to 10Hz | All amplitude 10mm[3 directions, each 1h] |
| | 10 to 55Hz | Acceleration 2G[3 directions, each 1h] |
| Vibration | Acceleration | 20G[3 directions, each 3 times] |
| | Vibration time | 11±5ms |
| Withstand voltage | Input terminal to frame ground | AC.2kV, 1min[25°C, 45 to 75(%)RH, cutout current 5mA] |
| | Input terminal to output terminal | |
| Insulation resistance | Input terminal to frame ground | 100MΩ min., DC.500V[25°C, 45 to 75(%)RH] |
| | Input terminal to output terminal | |
| | Output terminal to frame ground | |

**USE OF VARIOUS FUNCTIONS**

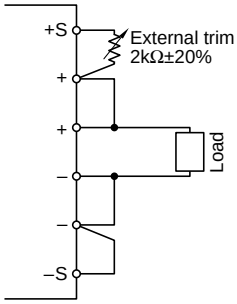
**SETTING OUTPUT VOLTAGE**

Voltage adjustment via an external trim must be used in order to set the fixed output voltage.

50W TYPE




100W TYPE




**• Remote ON-OFF**

The output voltage is turned ON-OFF by TTL level control voltage applied between the RC terminal and the (–) input terminal, or by opening or closing the connection between these terminals.

Output is ON when this control voltage level(H) is within the 2.4 to 5V range, or control is open.

Output is OFF when this control voltage level(L) is within the 0 to 0.4V range, or control is shorted.

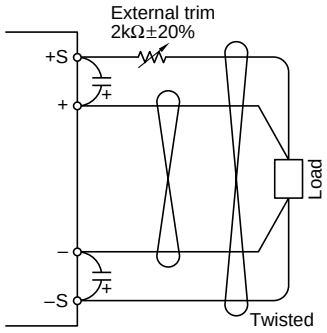
Since the RC terminal is internally pulled up, the RC terminal should be left open when not used.

**• Remote sensing**

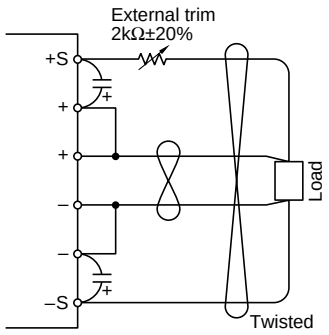
Compensation can become possible if remote sensing of such problems(disconnection of load from power supply, large voltage drop in load lines) is carried out. It is possible to compensate output voltage by up to 0.25V (5V rated output) or 0.4V(12 to 24V rated output).

(Caution: Output power should also be considered.)

50W TYPE




100W TYPE




Use twisted wire +S and –S, + and –.

If the overvoltage protection circuit readily trips or oscillates, a 470µF electrolytic capacitor should be placed between the +S and (+) terminals, as well as between the –S and (–) terminals(the capacitances prolong startup time).

If remote sensing is not used, the output voltage adjustment terminals should be connected.

**• Overcurrent protection circuit**

An overcurrent protection circuit is provided to protect the power supply circuit from problems such as load short circuits, etc. When the load current exceeds the current rating, the overcurrent protection circuit operates by lowering the output voltage. Output voltage returns to the previous value when the origin of the problem is removed.

**• Overvoltage protection circuit**

This stops the power supply output when the power supply voltage increases above the overvoltage detection point for any reason. This circuit can confirm whether normal voltage results from the power supply being turned ON again. In other words, operation will not begin due to an externally applied voltage.

**• Overheating protection circuit**

The overheating protection circuit operates by detection of abnormal heat generation of components due failure to satisfy the power supply cooling requirements, etc. When this protection circuit operates, the power supply might possibly not restart until the detected temperature fails, even if the power supply is restarted.

**• Short circuit caused by load**

When a load short circuit takes place for several minutes, the power supply is protected by operation of the protective circuit. Short circuits for long time periods can damage components. Such prolonged short circuits can markedly shorten the operating life of the power supply.

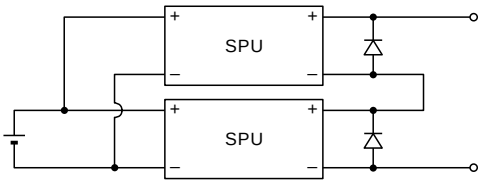
**APPLICATIONS**

**• Parallel operation**

Parallel operation(connecting power supply output terminals in parallel) to increase output current is not possible. However, it is possible to operate outputs in parallel(back amp) when the output current is within the output current rating of each power supply.

**• Series operation**

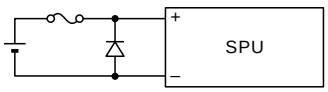
If output voltage is insufficient from a single unit, series connection of power supplies is possible to obtain a certain voltage. However, the maximum current is the lowest output current from among the power supplies.




A reverse voltage prevention diode is required. A diode should be selected that has a forward current rating at least twice that of the power supply current rating.

**• Polarity reversal of input voltage**

No built-in circuit protects against reversed polarity of the input. As shown in the diagram below, an external diode and fuse should be added when abnormal operation or reverse voltage are of concern.




A diode should be selected that has a forward current that is 2 to 3 times the fuse current rating.

Fuse current rating

50W type: 1.5 to 2A rating current(normal type fuse)

100W type: 2.5 to 3A rating current(normal type fuse)

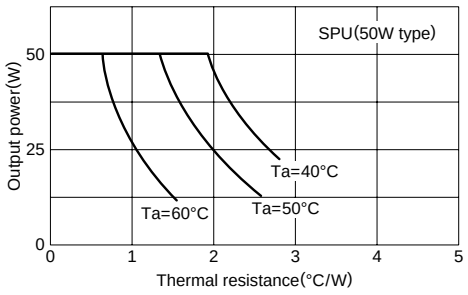
**• Cooling**

Attachment of a heat sink and provision of forced air cooling(fan) are necessary in order to use the power supply at maximum power. Selection of the heat sink and requirements for fan forced cooling are explained below.

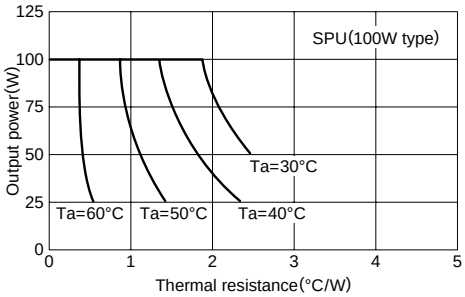
1) Thermal resistance of the heat sink is determined using the required output power and the temperature at which the power supply is used.

**RELATIONSHIP BETWEEN OUTPUT POWER AND HEAT SINK THERMAL RESISTANCE**

50W TYPE



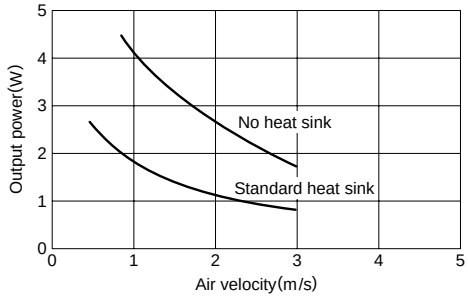

100W TYPE



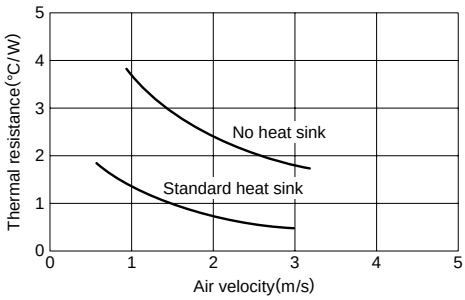

2) The required size of the heat sink decreases as the forced air velocity of the fan against the heat sink increases.

**RELATIONSHIP BETWEEN HEAT SINK THERMAL RESISTANCE AND FAN AIR VELOCITY**

50W TYPE




100W TYPE




3) The thermal resistance value determined in step 1) and step 2) is used to select a usable heat sink from among TDK's standard products or from the catalogs of commercial heat sink manufacturers.

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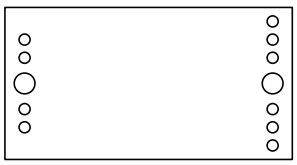
**MOUNTING**

**• Recommended terminal pattern**



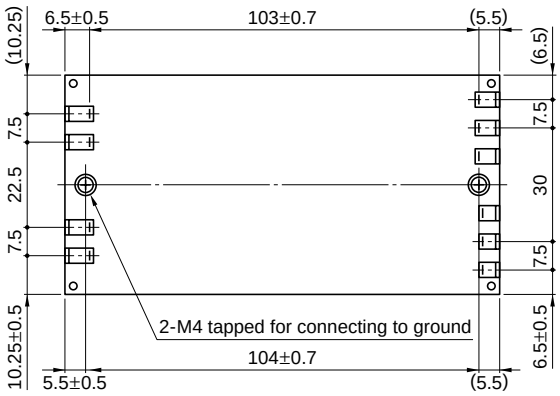
Terminal location(○)
Hole dia.: ø1.5 Round dia.: ø3
FG contact tab location(◯)
Hole dia.: ø4.5 Round dia.: ø9.5

Dimensions in mm

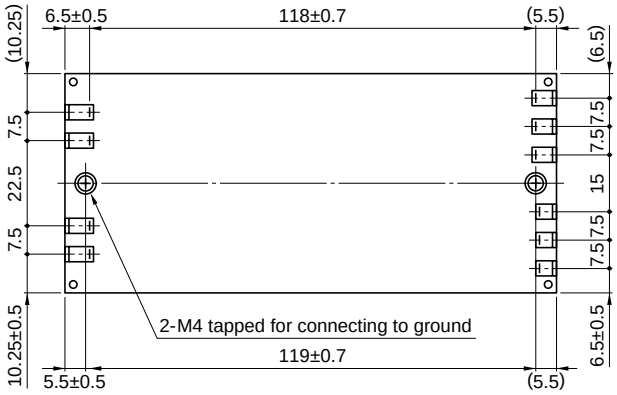
Refer to exterior drawing for spacing between terminals.

**• Exterior drawing**

50W TYPE




100W TYPE




Dimensions in mm

Tolerance: ±0.3mm

**• Attachment of power supply**

Tapped holes located at two locations(next to the terminals) on the case bottom are used to attach the power supply to the board. Use an M4 screw to attach the power supply, making certain not to penetrate into the base surface to a depth greater than 6mm.
(Recommended torque=1.08N • m)
Tapped holes located at two locations(next to the terminals) on the case surface are used to attach the power supply to the heat sink. Use an M3 screw to attach the power supply, making certain not to penetrate into the base surface to a depth greater than 6mm.
(Recommended torque=0.69N • m)
To improve the effectiveness of the heat sink, the application of thermally conductive grease between the heat sink and the power supply case(aluminum surface) during power supply installation is recommended.

**• Recommended soldering conditions**

Dipping: 230±5°C, 5s

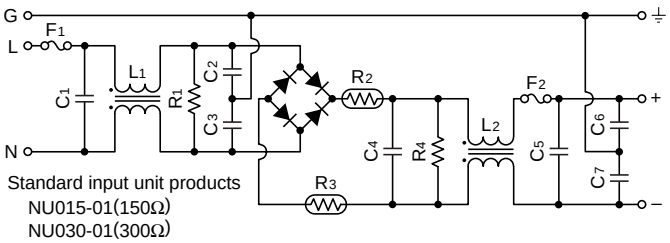
**• Cleaning recommendations**

Solvents: Xylene, IPA
Method: Brush cleaning
Due to the use of electrolytic capacitors, immersion of the entire power supply in solvent should be avoided.

**CONNECTION WITH POWER SUPPLY**

**• Input circuit**

When using an SPU power supply with AC power input, an input circuit is necessary for conversion of AC to DC input.
The input circuit can be constructed using discrete components(EMC filter, rectifier diode, smoothing capacitor, etc.), or a standard AC to DC converter can be used such as TDK's AC input unit NU series type.




Standard input unit products
NU015-01(150Ω)
NU030-01(300Ω)

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**• Construction precautions**

The following precautions should be taken when an input circuit is added to utilize AC power input, or when multiple power supplies are used to construct a high capacity power supply.

1) Ground line pattern between the input circuit and SPU power supply should be as thick and short as possible.
2) When multiple SPU power supplies are combined to construct a large power supplies are combined to construct a large power supply, a 1000 to 4700pF capacitor should be placed between each respective the + line to ground and the – line to ground. This capacitor should be able to withstand the input to ground voltage.
3) When multiple SPU power supplies are combined to form a large power supply, as much as possible, identical heat sinks should be used for each SPU power supply unit.
4) When the wiring pattern between the input power circuit and the SPU power supply is long, a 0.1µF min. capacitor should be installed between the + and – lines. This capacitor should be located as close as possible to the SPU power supply.
5) Noise emission from the SPU power supply to the input power lines is insufficiently reduced. If such noise is a problem, a filter should be added before the DC input terminals, or noise should be reduced at the AC input circuit.

**• Heat sink**

The heat sink is sold separately. An order should be place for the following products.

| Type | Part No. |
|---|---|
| 50W | 3JR0AB179 |
| 100W | 3JR0AB163 |

**• Additional comments**

1) Specifications and standards were determined at 25°C and nominal input/output, unless otherwise noted.
2) Ripple and noise(50MHz max.) were determined for 0 to +50°C temperature range and 10 to 100% load.